PATENT SPECIFICATION (11) 1 531 487

1 531 487

(21) Application No. 51077/75 (22) Filed 12 Dec. 1975 (19)
(31) Convention Application No. 7 442 974 (32) Filed 27 Dec. 1974 in
(33) France (FR)
(44) Complete Specification published 8 Nov. 1978
(51) INT. CL.[2] A61F 1/24
(52) Index at acceptance
A5R X6

(54) A COMPLETE HIP-JOINT PROSTHESIS

(71) We, MAHAY & CIE, a French Company, of 10, rue des Pres—20, rue Charles Infroit, 94400 Vitry, Sur Seine, France, do hereby declare the invention,

for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a complete prostheses for the hip-joint.

Many full hip-joint prostheses already exist, which are usually referred to by the name of the surgeon who designed them, for example, the Merle d'Aubigne prosthesis, the Thompson prosthesis, and the Mac Kee prosthesis.

These comprise a cephalic part which is fixed in the femur and a cotyloid part which is fixed in the hip bone.

This fixing is generally carried out with the use of cement, the bone being processed to provide a housing suitable for the shape of the prosthetic part, the said part being fixed in the said housing by cement.

This solution has an important disadvantage due to the fact that the cement reacts on the bone tissue.

It has already been proposed to provide prostheses without cement for the femur piece of the cephalic part, this piece being smooth and inserted just as it is in the bone. But in that case the formation of bone callus must be awaited before the prosthesis is allowed to take any load, and this is very long (up to six or eight months) and involves very difficult re-education work.

The present invention has as its aim to provide a complete hip-joint prosthesis whereby these disadvantages can be obviated, and more particularly a complete prosthesis the fixing of which in the bone does not require the use of any cement and which can be subjected to load almost immediately.

According to the invention there is provided a complete prosthesis for the hip-joint, comprising a cotyloid part adapted to be inserted in the hip bone and a cephalic part adapted to be inserted in the femur, the cephalic part fitting into the cotyloid part, in which the cephalic part comprises a femur piece having a cylindrical externally helically threaded shank portion adapted to be screwed into the medullar canal of the femur and a head part having a base member the underside of which has a bearing surface adapted to abut against a bone surface prepared in corresponding manner, the base member having an arm terminating in a part spherical head for insertion into the cotyloid part and a sleeve depending perpendicularly from and eccentric with respect to the bearing surface, the sleeve fitting in a bore of the same cross-section provided in the femur piece, and means being provided for securing the femoral part to the cephalic head part.

Preferably, the cotyloid part is externally cylindrical and screwthreaded so that it can be inserted in the bone by screwing, and comprises a plane bearing surface perpendicular to the axis of the screwthread, this surface being intended to abut against a bone surface prepared in a suitable way.

Preferably, the cotyloid part is made of metal and is lined internally with a cup made from plastics material held in position by an annular portion inserted in a corresponding groove of the cotyloid part.

Conveniently, the cotyloid part is formed with a screwthreaded wall of smaller height than the total height of the part, the unscrewthreaded end region of the part being dome-shaped. The cotyloid part may have an external bearing shoulder with a diameter larger than that of the screwthreaded wall.

In a preferred embodiment of the invention at least one bore is provided oblique to the longitudinal axis in the cotyloid part for receiving one or more screws which is or are adapted to penetrate into a thick portion of the hip bone to which the part is to be fixed.

An embodiment of the complete hip-joint prosthesis will now be described by way of example only with reference to the accompanying drawings wherein:

Figure 1 shows a lateral exploded view of the cephalic part of a prosthesis according to the invention;

Figure 2 shows in side view the cotyloid part,

Figure 3 and 4 show longitudinal sectional views of the same prosthesis parts respectively;

Figure 5 shows a section taken along the line V—V of Figure 3;

Figure 6 shows in section the prosthesis put in position in the bones of a hip-joint.

Referring now to the drawings in detail the complete prosthesis according to the invention comprises a cephalic part (Figure 1) and a cotyloid part (Figure 2).

The cephalic part (Figures 1, 3 and 5) is formed of a femur piece having a shank 1, which is screwthreaded at its lower portion with a high relief screwthread 2. In the upper portion of the shank 1 there is provided a recess 3 having a cross-section in the form of a regular polygon or the shank is formed with grooves providing detent elements in which a cephalic head part 5 fits by means of its correspondingly shaped sleeve 6. In the example illustrated the cross-section of the recess 3 is octagonal and the cephalic part can take up eight different angular positions relatively to the femur piece. The cephalic head part 5 also comprises a base member having a bearing surface 7 which is perpendicular to the axis of the shank 1. Extending from the base member is an arm terminating in a part spherical head. In an alternative arrangement (see Figure 6) the bearing surface 7 of the cephalic head part 5 may be provided with radial detent elements 22 which engage with corresponding detent elements on the upper face of the shank 1.

A screw 4 connects the shank 1 of the femur piece and cephalic head part 5 to one another so that they are locked together.

The cotyloid part (Figures 2 and 4) is formed of a short screwthreaded cylindrical portion 8 surmounted by a dome 9, the assembly being formed with an internal part-spherical recess 10 lined with a cup 11 of plastics material.

The cup 11 comprises an annular projection 20 corresponding to an annular groove of the part-spherical recess 10, which ensures the retaining of the cup 11 after it has been force-fitted into position.

Lateral bores 12 can be provided for the passage of fixing screws into the hip bone at the regions where the hip bone has portions of extra thickness.

As Figure 6 shows, the cotyloid part can comprise an abutment shoulder 24 which bears on the external face of the pelvis.

The rear face 13 of the screwthreaded portion 8 forms a retaining abutment for the cotyloid part which also comprises longitudinal grooves 14 for positioning it by screwing by means of a tool provided with engaging elements which are inserted in the grooves. An equivalent arrangement would be to provide holes in the shoulder 24 shown in Figure 6.

The fitting of the prosthesis is illustrated in Figure 6 where the hip bone 16 is internally screwthreaded at 15 over a height equal to that of the externally screwthreaded portion 8 of the cotyloid part. At the bottom of the internal screwthread a cup-shaped cavity 23 is bored out in which the dome 9 is located. The cotyloid part of the prosthesis is then put in position by screwing until its rear face 13 comes to abut against the corresponding face of the bone. If necessary, oblique locking screws can be inserted in the lateral bores 12 (see Figure 4) and a shoulder 24 can bear against the surface of the bone 16.

The medullary channel 17 of the femur 18 is drilled and internally screwthreaded with a screwthreading corresponding to that of the shank thread 2 of the cephalic part and the end 19 of the femur is sawn perpendicularly to the internal screwthreading so as to provide a bearing surface for the bearing surface 7 of the cephalic head part 5. The latter is inserted in the shank 1 of the femur piece at the selected angular position and fixed by the screw 4.

It should be noted that the cup 11 of plastics material can be shaped so as to provide a prosthesis of the retention type, i.e. the cup 11 is slightly smaller than the diameter of the ball shaped head of the cephalic head part 5. The ball shaped head must therefore be located in the cup 11 by force so that it is retained therein.

The foregoing description shows that the invention provides a full hip prosthesis the fitting of which does not require any cement and allows load to be accepted immediately, the forces being transmitted by the surfaces at which the parts bear on the bones.

The prosthesis has relatively little harmful effect on the bones, more particularly the hip bone, because of the shallow-depth screwthreading of the cotyloid part surmounted with its dome.

The construction of the cephalic part prevents the rubbing together of metal surfaces whilst utilising the strength of metal. However, it is possible within the framework of the present invention to make the cephalic part from a block of plastics material. The diameters of the cotyloid spherical cup and cephalic head part are preferably identical for prosthetic parts having different dimensions (for example 35 mm), and likewise the dimensional characteristics of the sleeve 6 recess 3 and screw 4. Thus the parts 1, 5 and 4 are interchangeable and match with one another whatever the other dimensions. In this way the surgeon can select for each patient the most suitable size shank of a cephalic part and cotyloid part from a wid range of prosthetic parts which can be pro-

duced having the same number of pieces or moulds.

The prosthesis is particularly strong because of its construction and the arrangement of the bearing surfaces perpendicular to the axis of the shank ensures the best possible transmission of forces.

The prosthesis will preferably be made of chrome-cobalt alloy, but any suitable alloy may be used.

Although in the foregoing description the sleeve 6 and the recess 3 have been given a polygonal (octagonal) cross-section, it would be an equivalent arrangement to make them in the form of grooved cylinders or cylinders with longitudinal splines or with detent elements 22 on the engaging bearing surfaces which are perpendicular to the axis of the shank. Any known means for allowing the shank 1 and the cephalic head part to take up a large number of possible angular positions relatively to one another without rotation being possible after fitting is to be considered as an equivalent.

WHAT WE CLAIM IS:—

1. A complete prosthesis of the hip joint, comprising a cotyloid part adapted to be inserted in the hip bone and a cephalic part adapted to be inserted in the femur, the cephalic part fitting into the cotyloid part, in which the cephalic part comprises a femur piece having a cylindrical externally helically threaded shank portion adapted to be screwed into the medullar canal of the femur and a head part having a base member the underside of which has a bearing surface adapted to abut against a bone surface prepared in corresponding manner, the base member having an arm terminating in a part spherical head for insertion into the cotyloid part and a sleeve depending perpendicularly from and eccentric with respect to the bearing surface, the sleeve fitting in a bore of the same cross-section provided in the femur piece, and means being provided for securing the femoral part to the cephalic head part.

2. A prosthesis according to claim 1, in which the cotyloid part has an externally screwthreaded cylindrical wall, adapted to be inserted in a hip bone by screwing, and a plane bearing surface perpendicular to the axis of the screwthread, adapted to abut against a prepared bone surface.

3. A prosthesis according to claim 2, in which an internal surface of the cotyloid part is lined with plastics material.

4. A prosthesis according to claim 3, in which the cotyloid part is made of metal and the lining is a cup of plastics material held in position by an annular portion inserted in a corresponding groove of the metal cotyloid part.

5. A prosthesis according to any of claims 2 to 4 in which the screwthreaded wall of the cotyloid part has a height less than the total height of the cotyloid part, the unscrewthreaded end region of the part being dome-shaped.

6. A prosthesis according to any of claims 2 to 5 in which the cotyloid part is formed with a bearing shoulder at one end, the diameter of which is greater than that of the screwthreaded wall.

7. A prosthesis according to any of claims 2 to 6 in which at least one bore is provided oblique to the longitudinal axis in the cotyloid part for receiving one or more screws which is or are adapted to penetrate into a thick portion of the hip bone to which the part is to be fixed.

8. A prosthesis according to any of claims 2 to 7 in which the screwthreaded wall of the cotyloid part is formed with longitudinal grooves in which the engaging elements of a screwing tool can be inserted.

9. A prosthesis according to claim 1 wherein the sleeve is tubular and is fitted coaxially in the femur piece.

10. A prosthesis according to claim 1 wherein the securing means is a screw means passing through the sleeve and being screwed into the femur piece.

11. A prosthesis according to claim 10, wherein the cephalic head part includes co-operating means for preventing angular movement of this part relative to the femur piece, the assembly being locked in the selected angular position by the screw means passing through the sleeve and being screwed into the femur piece.

12. A prosthesis according to claim 11, wherein the co-operating means is provided by the sleeve and the recess being of substantially identical polygonal cross-section.

13. A prosthesis according to claim 12, wherein the co-operating means further includes in one of the cephalic parts which cooperate with corresponding detent elements in the other of the parts.

14. A complete prosthesis for the hip, substantially as herein described with reference to the accompanying drawings.

For the Applicants:
LLOYD WISE, BOULY & HAIG,
Chartered Patent Agents,
Norman House,
105—109 Strand,
London, WC2R 0AE.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1978.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY
from which copies may be obtained.

1531487 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 1

Fig:1

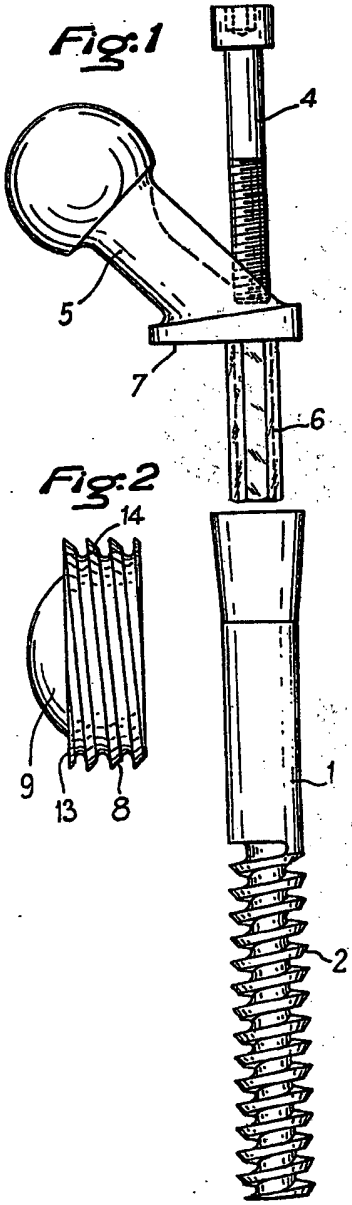


Fig:2

Fig:3

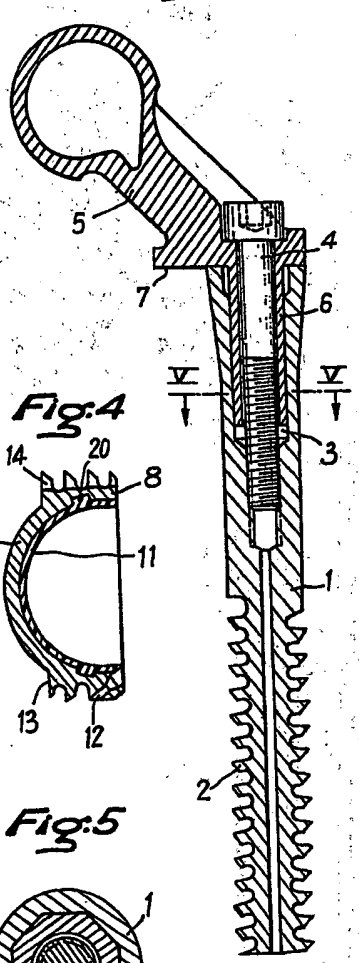
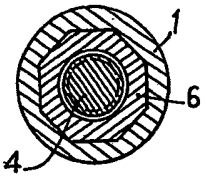


Fig:4

Fig:5



1531487
2 SHEETS

COMPLETE SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale

Sheet 2

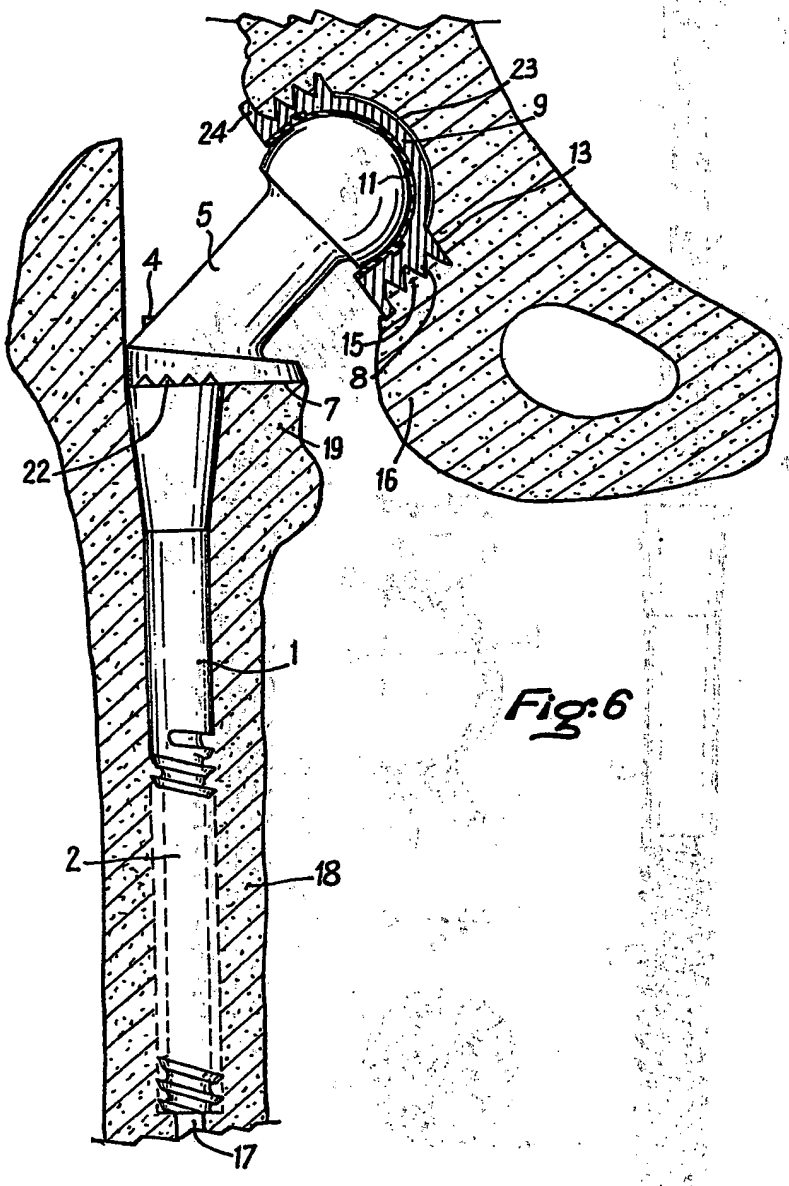


Fig: 6